THURSDAY, SEPTEMBER 12, 1907.

THE PHYSICAL LIFE OF BIRDS.

The Bird, its Form and Functions. By C. William Beebe. Pp. xii+496; illustrated. (London: Archibald Constable and Co., Ltd., 1907.) Price 14*s.* net.

MR. BEEBE'S handsome and beautifully illustrated book on the bird forms as charming and interesting an introduction to physical ornithology as the general reader, or the unscientific bird lover, can desire. In his preface, the author points out that too many students of ornithology stop short at the classification of birds, the naming of new species, and the observation of the habits of those that are known; and that not one of an audience of teachers to whom he had lectured, though they could identify fifty birds or more, knew the significance of the scales on a bird's foot. His book is intended to bridge this gap. It is an untechnical study of the bird in the abstract. His aim has been to take a few dead facts and clothe them with the living interest which will make them memorable and full of meaning to any lover of birds, and at the same time to keep them acceptable in tenor and truth to the most critical man of science. Wherever possible, a fact has been illustrated with a photograph from a preparation, or from a living bird, the author's belief being that when verbal exposition fails, pictorial interest will often fix a fact in the memory. How successful he has been in this a glance at the wealth of exquisite illustrations will show. Beginning at the root of all things avian, his first chapter deals with the birds' ancestors, the Ichthyornis, Archæopteryx, &c., both the remains and a "restoration" of the latter being illustrated.

We cannot follow in detail the seventeen chapters in which he deals with the entire structure of birds (treating each part in relation to the various functions it has to perform), their senses, their eggs, and the young in the egg. But we will turn to that on "beaks and bills," as a fair example of the treatment of the subjects. It is illustrated with thirty-three figures, and all the various forms of beak are described with their special adaptation to the wants and habits of the different birds. The beak is all-important to the bird.

> "Tie a man's hands and arms tightly behind his back, stand him on his feet, and tell him that he must hereafter find and prepare his food, build his house, defend himself from his enemies and perform all the business of life in such a position, and what a pitiable object he would present! Yet this is not unlike what birds have to do. As we have seen, almost every form of vegetable and animal life is used as food by one or another of the species. Birds have most intricately built homes, and their methods of defence are to be numbered by the score; the care of their delicate plumage alone would seem to necessitate many and varied instruments; yet all this is made possible, and chiefly executed, by one small portion of the bird—its bill or beak."

This picture is hardly overdrawn if we allow a little for feet and spurs and wings, which some birds use for getting food and making homes and fighting. In feeding alone, so many different kinds of beaks are wanted. To pick up small seeds, to probe the deepest calyxes of flowers, catch insects on the wing, and fish in the sea in various ways on or below the surface; to sift the mud and ooze, and skim the surface of the water, to chisel away wood and tear flesh; all these ways of feeding require different beaks, and they are all described in a delightful manner that anyone can understand. So wonderful is their variety and the variety of their functions that this one chapter, like the others, as the author observes, could easily be elaborated into one or more volumes. "A collection of bills of the various wading-birds would look like a complete set of surgical tools."

In the same way the rest of the subject is treated, the chapters on feathers (in which are some most interesting pictures of pelicans in their breeding haunts) and eggs being perhaps the most attractive. The book will take and hold a distinct place in the literature of the subject, for it is quite original and stands alone. Not only is it a most readable and interesting book, but a valuable one to teachers. A short list of books in the appendix indicates sources where much more detailed information may be obtained by those who desire it. They relate chiefly to North American birds, for the author writes from the New York Zoological Park. Nevertheless, his book is of world-wide interest. The wealth of illustration is one of its chief features, and the index is very full and elaborate.

ANIMAL MECHANICS.

Kinematik organischer Gelenke. By Prof. Dr. Otto Fischer. Pp. xii+261. (Brunswick: Friedr. Vieweg and Son, 1907.) Price 8 marks.

ENGLISH anatomists appear to have taken up the study of the joints and the movements performed by means of them almost entirely from the standpoint of descriptive anatomy, leaving the mathematical and more precise study somewhat severely alone. Proof of this statement is amply afforded by reference to the excellent bibliography which Prof. Fischer has appended to his handbook, the work under review, on the kinematics of living joints. No less than 127 references are given to German or French text-books or papers on the subject, whilst English or American authors are responsible for only nine. Of these, eight are papers to be found in various journals. The only extended mathematical treatment in English is that by Prof. Haycraft, entitled "Animal Mechanics," to be found in the second volume of Schäfer's "Physiology." The combination of a sufficient knowledge of mechanics with the necessary anatomy would therefore appear to be somewhat rare in this country. The subject, however, is one of great interest, and it is treated in a learned and at the same time lucid manner by Prof. Fischer, who has made for himself a considerable reputation in connection with it.

In the first section of this work, a more or less general investigation is made into the mechanical principles which govern the movements of organic joints. This is done by considering first a machine

© 1907 Nature Publishing Group

joint, such as an ordinary hinge, and then the points of difference between such a joint and an organic joint. In a hinge the form of the surfaces in contact is practically constant, as the joint moves between its extreme positions. This is rarely the case, of course, in a living joint. The variations introduced by these changes are carefully considered, the diagrams aiding very materially in the treatment. The mathematics employed requires some knowledge of differential and integral calculus, and also of coordinate geometry, but presents no very serious difficulties.

The succeeding part of the book is of great interest, as it contains a description of Prof. Fischer's own methods of showing graphically the movements of single joints and of combinations of joints. There have been many advances in this direction since the Webers, so far back as 1830, investigated the variation in the position of the centre of gravity of the body in walking and running. M. Marey introduced photographic methods, somewhat resembling modern kinematograph work. The method described in the present work is the best yet devised. A man is clothed from neck to feet in black, and a series of Geissler tubes, eleven in number, are arranged symmetrically on his head and limbs. These are joined to the secondary of a Ruhmkorff coil, the primary of which is interrupted about twenty-five times per second. The man's movements are then recorded photographically by means of cameras placed on either side and in front and behind. In this way records in three directions in space were obtained, and these were coordinated by means of networks of squares photographed at the same time. The phases of movement, either of the whole body or of a single joint-system such as the arm, are thus illustrated.

Prof. Fischer brings much originality into his treatment of a by no means easy subject. The publication of this handbook may well direct the attention of English students to a branch of anatomy which has been somewhat neglected, but in which there remains much to be done.

GAS ANALYSIS.

Traité pratique de l'Analyse des Gaz. By M. Berthelot. Pp. ix+483. (Paris: Gauthier Villars, 1906.) Price 17 francs.

IN that branch of chemical analysis dealing with gases there is by no means the superabundance of text-books characteristic of other branches of analytical work, and it is noteworthy that such works as we possess are nearly all memoirs of original work by the author, or have been developed from that form. The names of Bunsen, Winkler, Hempel, and Travers occur in this connection, and the present work is no exception. In some of his earliest researches, M. Berthelot was met with the necessity of devising methods for the analysis of gases, and many of the methods described in this book were used by him as early as 1858. After an introduction, the work is divided into five sections dealing with the collection and storage of gases, methods of qualitative analysis, general methods of quantitative analysis, monographs, and the recognition and estimation of single gases and mixtures.

The whole book is strongly impressed with the author's individuality, and a considerable proportion of the section dealing with qualitative analysis is original, especially the chapters on the pyrogenic analysis of gases and spectroscopy. In the latter connection, a simple apparatus is described by means of which a spectroscopic examination of a gas at the ordinary atmospheric pressure can be rapidly made, and in the section dealing with the properties of each gas in detail a table of the chief lines observed by this method is given. The actions of the electric spark and the silent discharge are also special to the author, and his methods are expounded in detail. The remarks on the use of absorbents are worthy of close attention, it being rightly pointed out that the reduction of volume by treating with a given absorbent cannot be taken as a proof that a particular gas is present: a gas must be isolated in a pure state before its presence in a gas mixture can be taken as proved. On the quantitative side more exception can be taken to the methods expounded, which, indeed, leave much to be desired, both on the score of rapidity and precision. Water jackets are not used for the measuring vessels, the temperature being controlled by immersion in a large mercury trough holding from 16 to 20 litres, and this is described as "the essential instrument in all exact manipulations relating to gases and their analysis." As this trough requires about 600 lb. of mercury to fill it to its working level, exact gas analysis would of necessity be confined to a very limited number of laboratories if this dictum were to be accepted. The sections on mercury pumps, calibration of measuring vessels, and determination of gaseous densities are also entirely out of accord with present-day standards of accuracy. References to other workers in the same field are rare, and the description of their apparatus and methods not always accurate. The account given of Hempel's gas burette and its use on p. 269 is an example of this. The commencement of the description is that of the Hempel burette, but the figure and manipulation correspond to a modified Winkler gas burette, and Prof. Hempel would hardly recognise the description of his pipette as "formed of two bulbs connected by a fine tube and each furnished with a recurved capillary tube."

In the fourth section a monograph is given of each gas, and this section will perhaps be found to be the most valuable part of the work. It is a drawback that no references to original memoirs are given in this section, and for this reason it is difficult to make out whether the densities given are experimental or calculated, or whether such a figure as -93° C. for the boiling point of propylene is the result of a misprint or an inaccurate observation.

The book is one which everyone interested in gases should have on their bookshelves, but, like the classical work of Bunsen on the same subject, it cannot be regarded as of practical service as a text-book at the present day. Its value will be historical and personal as the last published work of a great French chemist.

© 1907 Nature Publishing Group